

What is claimed is:

1. A turbo decoder having a state metric, comprising:
branch metric calculation means for calculating a
5 branch metric by receiving symbols through an input buffer;
state metric calculation means for calculating a
reverse state metric by using the calculated branch metric
at said branch metric calculating means, storing the
reverse state metric in a memory, calculating a forward
10 state metric; and

log likelihood ratio calculation means for
calculating a log likelihood ratio by receiving the forward
state metric from said state metric calculation means and
reading the reverse state metric saved at a memory in said
15 state metric calculation means.

2. The turbo decoder in recited as claim 1, wherein
said state metric calculation means includes:

reverse state metric calculation means for
20 calculating a reverse state metric in case an input i is 0
according to states of the branch metric; and

forward state metric calculation means for
calculating a forward state metric in case an input i is 0
and i is 1 according to states of the branch metric.

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3. A calculation method implemented to the turbo
decoder, comprising steps of:

- a) calculating a branch metric by receiving symbols;
- b) calculating a reverse state metric in case an input i is 0 by using the calculated branch metric and saving the calculated reverse state metric in a memory;
- 5 c) calculating a forward state metric in case an input i is 0 and the input i is 1 by using the calculated branch metric;
- d) calculating a log likelihood ratio by using the forward state metric and the reverse state metric; and
- 10 e) storing the log likelihood ratio.

4. The calculation method as recited in claim 3, wherein the reverse state metric B_k^m , which is k^{th} reverse state metric with state m , is calculated by using an equation $\prod_{j=0}^1 (B_{k+1}^{F(j,m)} + D_{k+1}^{j,f(m)})$, wherein m is a state of a trellis diagram; k is a stage; j is a $(k-1)^{th}$ input for a reverse state metric; $f(m)$ is $(k+1)^{th}$ state related to k^{th} state with state m ; $F(j,m)$ is a function defined as $F(j,m)=f(m)$ for $j=0$ and $F(j,m) = s(f(m))$ for $j=1$; $s(m)$ is a function provides binary number of m with a most significant bit complemented; $\prod_{j=0}^1$ is a function defined as $\prod_{j=0}^1 A_k^j = A_k^0 \prod_{j=0}^1 A_k^1 = \log_e(e^{A_k^0} + e^{A_k^1})$; $B_{k+1}^{F(j,m)}$ is a $(k+1)^{th}$ reverse state metric with state $F(j,m)$ and $D_{k+1}^{j,f(m)}$ is $(k+1)^{th}$ branch metric with state m and $(k+1)^{th}$ input.

5. The calculation method as recited in claim 3, wherein the forward state metric A_k^m , which is k^{th} forward state metric with state m , is calculated by using an equation $\prod_{j=0}^1 (D_k^{j,b(j,m)} + A_{k-1}^{b(j,m)})$ wherein m is a state of a trellis diagram; k is a stage; $b(j,m)$ is a $(k-1)^{th}$ reverse state; j is a $(k+1)^{th}$ input for a reverse state metric; $\prod_{j=0}^1$ is a function defined as $\prod_{j=0}^1 A_k^j = A_k^0 \prod_{j=0}^1 A_k^1 = \log_e(e^{A_k^0} + e^{A_k^1})$; $A_{k-1}^{b(j,m)}$ is a $(k-1)^{th}$ forward state metric with state $b(j,m)$ and $D_k^{j,b(j,m)}$ is k^{th} branch metric with state $b(j,m)$.

6. The calculation method as recited in claim 3, wherein the log likelihood ratio L_k is calculated by using an equation $\prod_{m=0}^{2^v-1} (A_k^{1,m} + B_k^{s(m)}) - \prod_{m=0}^{2^v-1} (A_k^{0,m} + B_k^m)$ wherein m is a state of a trellis diagram; k is a stage; j is a $(k-1)^{th}$ input for a reverse state metric; $s(m)$ is a function provides binary number of m with a most significant bit complemented; $\prod_{j=0}^1$ is a function defined as $\prod_{j=0}^1 A_k^j = A_k^0 \prod_{j=0}^1 A_k^1 = \log_e(e^{A_k^0} + e^{A_k^1})$; $A_k^{1,m}$ is a k^{th} forward state metric with state m and input 1; $B_k^{s(m)}$ is a k^{th} reverse state metric with state $s(m)$; $A_k^{0,m}$ is a k^{th} forward state metric with state m

and input 0 and B_k^m is a k^{th} reverse state metric with state m .

7. The calculation method as recited in claim 3,
 5 wherein the reverse state metric B_k^m , which is k^{th} reverse state metric with state m , is calculated by using an equation $\sum_{j=0}^1 (B_{k+1}^{F(j,m)} + D_{k+1}^{j,f(m)})$, wherein m is a state of a trellis diagram; k is a stage; j is a $(k-1)^{th}$ input for a reverse state metric; $f(m)$ is $(k+1)^{th}$ state related to k^{th}
 10 state with state m ; $F(j,m)$ is a function defined as $F(j,m)=f(m)$ for $j=0$ and $F(j,m) = s(f(m))$ for $j=1$; $s(m)$ is a function provides binary number of m with a most significant bit complemented; $\sum_{j=0}^1$ is a function defined as $\sum_{j=0}^1 A_k^j = A_k^0 2 A_k^1 = \log_2(2^{A_k^0} + 2^{A_k^1})$; $B_{k+1}^{F(j,m)}$ is a $(k+1)^{th}$ reverse
 15 state metric with state $F(j,m)$ and $D_{k+1}^{j,f(m)}$ is $(k+1)^{th}$ branch metric with state m and $(k+1)^{th}$ input.

8. The calculation method as recited in claim 3,
 wherein the forward state metric A_k^m , which is k^{th} forward
 20 state metric with state m , is calculated by using an equation $\sum_{j=0}^1 (D_k^{j,b(j,m)} + A_{k-1}^{b(j,m)})$ wherein m is a state of a trellis diagram; k is a stage; $b(j,m)$ is a $(k-1)^{th}$ reverse state; j

is a $(k+1)^{th}$ input for a reverse state metric; $\prod_{j=0}^1$ is a function defined as $\prod_{j=0}^1 A_k^j = A_k^0 \prod_{j=0}^1 A_k^j = \log_2(2^{A_k^0} + 2^{A_k^1})$; $A_{k-1}^{b(j,m)}$ is a $(k-1)^{th}$ forward state metric with state $b(j,m)$ and $D_k^{j,b(j,m)}$ is k^{th} branch metric with state $b(j,m)$.

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9. The calculation method as recited in claim 3, wherein the log likelihood ratio L_k is calculated by using an equation $\prod_{m=0}^{2^r-1} (A_k^{l,m} + B_k^{s(m)}) - \prod_{m=0}^{2^r-1} (A_k^{0,m} + B_k^m)$ wherein m is a state of a trellis diagram; k is a stage; j is a $(k-1)^{th}$ input for a reverse state metric; $s(m)$ is a function provides binary number of m with a most significant bit complemented; $\prod_{j=0}^1$ is a function defined as $\prod_{j=0}^1 A_k^j = A_k^0 \prod_{j=0}^1 A_k^j = \log_2(2^{A_k^0} + 2^{A_k^1})$; $A_k^{l,m}$ is a k^{th} forward state metric with state m and input l ; $B_k^{s(m)}$ is a k^{th} reverse state metric with state $s(m)$; $A_k^{0,m}$ is a k^{th} forward state metric with state m and input 0 and B_k^m is a k^{th} reverse state metric with state m .

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10. A computer-readable recording medium storing instructions for executing a calculation method implemented to the turbo decoder, comprising functions of:

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calculating a branch metric by receiving symbols;

calculating a reverse state metric in case an input i is 0 by using the calculated branch metric and saving the calculated reverse state metric in a memory;

calculating a forward state metric in case an input i is 0 and the input i is 1 by using the calculated branch metric;

calculating a log likelihood ratio by using the forward state metric and the reverse state metric; and
storing the log likelihood ratio.